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A Study of Magnesium Hydride Thin Film Phase Transition Kinetics Using *In-Situ* Hydriding/Dehydriding STEPHEN KELLY, RAJ KELEKAR, HERMIONE GIFFARD, BRUCE CLEMENS, Stanford University — Magnesium is an attractive material for hydrogen storage because it stores an appreciable amount of hydrogen (7.6 wt.%) as magnesium hydride (MgH_2), is abundant in the earth's crust and is relatively inexpensive. Understanding of the structural changes and associated kinetics for the magnesium/magnesium hydride phase transition is crucial to engineering practical metal hydride hydrogen storage materials involving magnesium. A thin film architecture allows us to deposit and analyze precisely controlled structures in order to gain insight into the kinetic mechanisms present in the phase change. Using UHV sputter deposition onto a variety of substrates we have grown Mg thin films with varying degrees of structural texture and orientation. Using x-ray diffraction with *in-situ* sample heating we see evidence for a solid phase epitaxial (SPE) regrowth mechanism for the Mg regrowing from the MgH_2 in epitaxial Mg thin films and observe kinetic differences for the discharging of films with different Mg orientations (Mg c-axis in/out of the sample plane). We also determined the crystallographic orientation correlation for the Mg to MgH_2 transition in our epitaxial thin films. Here we also present our recent work examining and analyzing the kinetics for sample *charging* utilizing a variety of methods.

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